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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/785,436	02/20/2001	Shinji Takeda	TM&K0007	8173

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EXAMINER

GEYER, SCOTT B

ART UNIT PAPER NUMBER

2829

DATE MAILED: 10/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/785,436

Applicant(s)

MAEKAWA ET AL.

Examiner

Scott B. Geyer

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 June 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 29,31,36-38 and 49-62 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 38 and 49-54 is/are allowed.
- 6) ☒ Claim(s) 29,31,36,37 and 55-62 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 February 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 08/981,702.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 9,10,15.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

1. This non-final office action addresses claims 29, 31, 36-38 and 49-62.

Election/Restrictions

2. The restriction requirement of the previous action, paper no. 16, is withdrawn.

Drawings

3. The drawings are objected to because numerals "3" and "4", from figures 1(a) and 1(b) are not disclosed in the specification. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

4. The disclosure is objected to because of the following informalities: the specification does not recite details of numerals "3" and "4" from figures 1(a) and 1(b).
Appropriate correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

6. Claims 31, 37 and 62 are rejected under 35 U.S.C. 102(a) as being anticipated by Morita et al. (5,406,124).

6A. As to **claim 31**, Morita et al. teach a die bonding material 4 in figure 1 used to attach a chip 1 to a support member (lead frame) 2. The die bonding material is composed of an insulating adhesive tape that is made of a polyimide polymer (column 4, lines 26 et seq.). Further, as shown in figure 1, the insulating adhesive tape 4 has planar dimensions not larger than the chip 1 and is not protruding outward from a region of the chip 1 at a stage where the chip 1 is bonded to the support member (lead frame) 2.

6B. As to **claim 37**, Morita et al. teach a method of attaching a chip to a support member (lead frame) wherein a die bonding material 4 in figure 1 is used to attach a chip 1 to a support member (lead frame) 2 (see also column 7, lines 1 et seq.). The die bonding material is composed of an insulating adhesive tape that is made of a polyimide polymer (column 4, lines 26 et seq.). Further, as shown in figure 1, the insulating adhesive tape 4 has planar dimensions not larger than the chip 1 and is not protruding outward from a region of the chip 1 at a stage where the chip 1 is bonded to the support member (lead frame) 2.

6C. As to **claim 62**, Morita et al. teach a die bonding material 4 in figure 1 used to attach a chip 1 to a support member (lead frame) 2. The die bonding material is composed of an insulating adhesive tape that is made of a polyimide polymer (column 4, lines 26 et seq.). Further, as shown in figure 1, the insulating adhesive tape 4 has planar dimensions not larger than the chip 1 and is not protruding outward from a region

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of the chip 1 at a stage where the chip 1 is bonded to the support member (lead frame)

2. Morita et al. also teach encapsulating of the device with resin 3 in figure 1.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 29, 36, 60 and 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morita et al. (5,406,124) in view of Yusa et al. (5,667,899).

8A. As to **claim 29**, Morita et al. teach a die bonding material 4 in figure 1 used to attach a chip 1 to a support member (lead frame) 2. The die bonding material is composed of an insulating adhesive tape that is made of a polyimide polymer (column 4, lines 26 et seq.). Further, as shown in figure 1, the insulating adhesive tape 4 has planar dimensions not larger than the chip 1 and is not protruding outward from a region of the chip 1 at a stage where the chip 1 is bonded to the support member (lead frame) 2. Morita et al. do not teach a film having a peel strength of 0.5 Kgf/5x5mm chip or above, when the chip is attached to the support member. However, Yusa et al. does disclose peel strengths above 0.5 Kgf for a piece as large as 8x8mm (column 14, lines 26 et seq. and also Table 10). Yusa et al. further teaches attaching conductive bonding film pieces to semiconductor chips of similar dimensions, including: film of 4mm x 4mm and chip of 4mm x 4mm (column 13, lines 18-20) and film of 8mm x 8mm and chip of

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8mm x 8mm (column 14, lines 26-28). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the device of Morita et al. with an adhesive having a peel strength of 0.5 Kgf/5x5mm or above as taught by Yusa et al. so as to assure the chip and leadframe are securely bonded to each other.

As to **claim 60**, Morita et al. teach the insulating adhesive tape 4 has planar dimensions not larger than the chip 1 and is not protruding outward from a region of the chip 1 at a stage where the chip 1 is bonded to the support member (lead frame) 2, as shown in figure 1.

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8B. As to **claim 36**, Morita et al. teach a method of attaching a chip to a support member (lead frame) wherein a die bonding material 4 in figure 1 is used to attach a chip 1 to a support member (lead frame) 2 (see also column 7, lines 1 et seq.). The die bonding material is composed of an insulating adhesive tape that is made of a polyimide polymer (column 4, lines 26 et seq.). Further, as shown in figure 1, the insulating adhesive tape 4 has planar dimensions not larger than the chip 1 and is not protruding outward from a region of the chip 1 at a stage where the chip 1 is bonded to the support member (lead frame) 2. Morita et al. do not teach a film having a peel strength of 0.5 Kgf/5x5mm chip or above, when the chip is attached to the support member. However, Yusa et al. does disclose peel strengths above 0.5 Kgf for a piece as large as 8x8mm (column 14, lines 26 et seq. and also Table 10). Yusa et al. further teaches attaching conductive bonding film pieces to semiconductor chips of similar dimensions, including: film of 4mm x 4mm and chip of 4mm x 4mm (column 13, lines 18-20) and film of 8mm x

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8mm and chip of 8mm x 8mm (column 14, lines 26-28). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the method of Morita et al. with an adhesive having a peel strength of 0.5 Kgf/5x5mm or above as taught by Yusa et al. so as to assure the chip and leadframe are securely bonded to each other.

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8C. As to **claim 61**, Morita et al. teach a die bonding material 4 in figure 1 used to attach a chip 1 to a support member (lead frame) 2. The die bonding material is composed of an insulating adhesive tape that is made of a polyimide polymer (column 4, lines 26 et seq.). Further, as shown in figure 1, the insulating adhesive tape 4 has planar dimensions not larger than the chip 1 and is not protruding outward from a region of the chip 1 at a stage where the chip 1 is bonded to the support member (lead frame) 2. Morita et al. also teach encapsulating of the device with resin 3 in figure 1. Morita et al. do not teach a film having a peel strength of 0.5 Kgf/5x5mm chip or above, when the chip is attached to the support member. However, Yusa et al. does disclose peel strengths above 0.5 Kgf for a piece as large as 8x8mm (column 14, lines 26 et seq. and also Table 10). Yusa et al. further teaches attaching conductive bonding film pieces to semiconductor chips of similar dimensions, including: film of 4mm x 4mm and chip of 4mm x 4mm (column 13, lines 18-20) and film of 8mm x 8mm and chip of 8mm x 8mm (column 14, lines 26-28). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the device of Morita et al. with an adhesive

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having a peel strength of 0.5 Kgf/5x5mm or above as taught by Yusa et al. so as to assure the chip and leadframe are securely bonded to each other.

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9. Claim 55 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morita et al. (5,406,124) and Yusa et al. (5,667,899) as applied to claim 29 above, and further in view of Sutton, Jr. (4,358,581).

As to **claim 55**, neither Morita et al. nor Yusa et al. teach a film with a modulus of elasticity (Young's modulus) of 10 MPa or less at a temperature of 250°C.

Sutton, Jr. teaches a Young's modulus for a polyimide film of 2350 MPa at 25°C and 1400 MPa at 200°C. Sutton, Jr. does not specifically teach the instant Young's modulus of 10 MPa at 250°C. However, Sutton, Jr. does teach that the Young's modulus for a specific film will decrease as the temperature increases. Thus, the skilled artisan would find obvious to employ without undue experimentation the instant Young's modulus at the given temperature for a specific film, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering optimum or workable ranges for a result-effective variable involves only routine skill in the art. *In re Aller*, 105 USPQ 233. The skilled artisan would find obvious that modifying the type of film used and the film's temperature, the instant Young's modulus would be attained. Further, the applicant has not specifically recited for which film the Young's modulus (modulus of elasticity) value is recited. The applicant should also note that when the structure recited in a reference is substantially identical to that of the claim, claimed properties, in this example a Young's modulus of a material, are presumed to be

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inherent. Also, for composition claims, if the composition is physically the same, it must have the same properties. See MPEP 2112.01.

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10. Claims 56 and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morita et al. (5,406,124) and Yusa et al. (5,667,899) as applied to claim 29 above, and further in view of Inoue et al. (5,728,473).

As to **claim 56**, neither Morita et al. nor Yusa et al. teach a film having water absorption of 1.5% by volume or less. However, Inoue et al. teach an adhesive polyimide with water absorption of not more than 1 wt. %, and that the adhesive polyimide is preferably in the form of a film (column 3, lines 63-67, continued to column 4, lines 1-3). These polyimide adhesive films are used to bond semiconductor chips to lead frames (column 1, lines 14-22). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the device of Morita et al. and Yusa et al. with a film having a low water absorption percentage as taught by Inoue et al. since the greater presence of water can lead to deleterious effects on the semiconductor chip and lead frame to which the adhesive is attached.

As to **claim 58**, Inoue et al. teach an adhesive polyimide with water absorption of not more than 1 wt. %, and that the adhesive polyimide is preferably in the form of a film (column 3, lines 63-67, continued to column 4, lines 1-3).

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11. Claim 57 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morita et al. (5,406,124) and Yusa et al. (5,667,899) as applied to claim 29 above, and further in view of Suzuki et al. (5,234,522).

As to **claim 57**, neither Morita et al. nor Yusa et al. teach a film having a residual volatile component of 3.0% by weight or less. However, Suzuki et al. teach a residual volatile matter of not more than 1.5% by weight and preferably not more than 1% (column 3, lines 59-62). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the device of Morita et al. and Yusa et al. with a low residual volatile percentage as taught by Suzuki et al. since a high residual volatile component remaining in adhesives would cause the adhesive to peel and have voids, both of which are undesirable for bonding chips to lead frames.

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12. Claim 59 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morita et al. (5,406,124) and Yusa et al. (5,667,899) as applied to claim 29 above, and further in view of Schuft (5,141,050).

As to **claim 59**, neither Morita et al. nor Yusa et al. teach a void volume of 10% or less of the die-bonding material (adhesive) and at an interface between the adhesive and the support member (lead frame) when the chip has been attached to the lead frame. However, Schuft teaches a void volume of 10% or less (column 4, lines 6 et seq.) for adhesive material, or thermal conduit (column 2, lines 42 et seq.). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the device of Morita et al. and Yusa et al. with a low void volume percentage as

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taught by Schuft as a void volume could trap air and moisture, which would have deleterious effects upon the chip and lead frame for which the adhesive is used to attach together.

Allowable Subject Matter

13. Claims 38 and 49-54 are allowed.

14. The following is a statement of reasons for the indication of allowable subject matter: independent claim 38 recites a process for fabricating a semiconductor device comprising attaching a chip to a support member with a die bonding material. The claim further recites temperature conditions of 150°C to 250°C, a bonding time of 0.1 (inclusive) to 2 seconds and a pressure of 0.1 to 4 gf/mm². The prior art of record and to the examiner's knowledge does not teach or render obvious, at least to the skilled artisan the instant invention, regarding the bonding limitations as recited by independent claim 38, specifically to the temperature, time and pressure conditions. Claims 49-54, which are dependent upon claim 38, are also allowable.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott B. Geyer whose telephone number is (703) 306-5866. The examiner can normally be reached on weekdays, between 10:00am - 6:30pm. The examiner may also be reached via e-mail: scott.geyer@uspto.gov

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael J. Sherry can be reached on (703) 308-1680. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

S.B.G.

S.B.G.
September 19, 2002

A handwritten signature in black ink, appearing to read "Michael Sherry", with a date "9/26/02" written below it.

MICHAEL SHERRY
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800